Annual monitoring and maintenance activities at the site would result in no increases in traffic volumes.

4.2.17 Disposal Cell Failure from Natural Phenomena

It is possible that a disposal cell failure could occur at the Klondike Flats site. The possibility of failure at this site would be much lower than at the Moab site because it was selected for analysis, in part, to avoid the more dynamic characteristics of the Moab site (see Chapter 3.0). The Klondike Flats site is not located near a river, does not have historical seismic activity, and is not prone to settling. In addition, this site is located farther away from populated areas or sensitive habitats than the Moab site, which would reduce the potential risks if a disposal cell failure occurred. Therefore, the possibility of a failure occurring and resulting in potential risks at the Klondike Flats site would be much lower than the potential risks of a disposal cell failure at the Moab site. For this reason, a potential failure at this site was not evaluated.

4.2.18 Environmental Justice

The basis for DOE's analysis of environmental justice impacts is described in Section 4.1.18. One census block area with a reported annual household income of less than $18,244 (poverty level for a family of four) is found about 30 miles north of the site. Although this population could be exposed to small doses of radiation as a result of activities under this alternative, there is no evidence that it would be exposed at a level any higher than the general population. Although traffic in central Moab would be an adverse impact, it does not appear that minority or low-income populations would suffer disproportionately.

DOE has identified no high and adverse impacts, and no minority or low-income populations would be disproportionately affected by the implementation of the Klondike Flats disposal alternative.

4.3 Off-Site Disposal (Crescent Junction Site)

This section discusses the short-term and long-term impacts associated with the second of three off-site disposal alternatives. The Crescent Junction site is located approximately 31 miles north of the Moab site and approximately 13 miles north of the Klondike Flats site. The impacts are based on the proposed actions described in Section 2.2, and the affected environment described in Section 3.3, of this EIS. This alternative may result in the following impacts:

- Impacts at the Moab site
- Impacts at the Crescent Junction site
- Transportation impacts associated with moving tailings from the Moab site to the Crescent Junction site
- Monitoring and maintenance impacts at the Crescent Junction site

The combined impacts that may result from these activities are summarized for each assessment area (e.g., Geology and Soils) at the end of each subsection. For many activities, impacts at the Moab site would not differ significantly from those described in Section 4.2 for Klondike Flats. Likewise, construction and operation impacts at the Crescent Junction site, as well as monitoring and maintenance impacts, would be similar to those addressed for the Klondike Flats site.

Transportation impacts would vary depending upon the transportation mode (truck, rail, or slurry pipeline). Impacts for the route segments for the first 18 miles from the Moab site to the Klondike Flats site were addressed in Section 4.2. Therefore, only impacts for the additional 13 miles (from Klondike Flats) are assessed in this section. Contaminated vicinity property materials would be transported from the Moab site to the Crescent Junction site. Therefore, impacts associated with transporting vicinity property materials are not addressed separately. Impacts associated with borrow areas are addressed collectively in Section 4.5 and are therefore not addressed in this section.

4.3.1 Geology and Soils

Construction and operations impacts to geology and soils at the Moab and Crescent Junction sites, as well as monitoring and maintenance impacts, would be very similar to or the same as those described in Section 4.2.1 for the Klondike Flats off-site disposal alternative. Impacts from all sources would also be qualitatively identical and quantitatively very similar to those described for the Klondike Flats site in Section 4.2.1. The only differences would be the degree of off-site disturbances associated with transportation modes, as seen by comparing Table 4–31 and Table 4–20. The potential for long-term erosion of soils adjacent to the disposal cell exists but would be controlled by construction design enhancements.

Table 4–31. Summary of Short-Term Soil Impacts—Crescent Junction Off-Site Disposal Alternative

Soil Disturbance Location or Source	Area of Soil Disturbance (acres)
Moab site (on site)	439
Crescent Junction (on-site; including transportation disturbances)	
Truck transportation	435
Rail transportation	420
Slurry pipeline transportation	435
Moab to Crescent Junction (off-site; exclusive of on-site)	
Truck transportation	13
Rail transportation	57
Slurry pipeline transportation	164

4.3.2 Air Quality

Construction and operations impacts to air quality at the Moab and Crescent Junction sites, as well as monitoring and maintenance impacts, would be very similar to or the same as those described in Section 4.2.2 for the Klondike Flats off-site disposal alternative. Emissions of criteria air pollutants, including carbon monoxide, nitrogen dioxide, sulfur dioxide, and PM_{10}, would occur at the Moab site, Crescent Junction site, vicinity properties, and borrow areas because of the operation of heavy construction equipment and ground water remediation equipment. No criteria air pollutant emission concentrations would exceed NAAQS as a result of construction and operations at the Crescent Junction site. Consequently, the analysis of air quality impacts is not repeated in this section.

4.3.3 Ground Water

Ground water impacts as a result of construction and operations at the Moab site and of monitoring and maintenance at the Crescent Junction site would be comparable to those described in Section 4.2.3.1. Therefore, these concerns are not addressed further in this section.

4.3.3.1 Construction and Operations Impacts at the Crescent Junction Site

No anticipated adverse impacts on regional or local ground water quality would result from a proposed disposal cell in the Crescent Junction area because of the depth (3,000 ft) to the uppermost aquifer. In addition, the Dakota Sandstone Formation is separated from the surface by a very thick section of relatively impermeable Mancos Shale, which forms an aquitard that inhibits ground water migration to deeper ground water. Estimated travel time for any water seeping from the cell to migrate through the Mancos Shale and reach the uppermost aquifer is estimated at over 170,000 years. This estimate is based on a typical hydraulic conductivity value of 1.0×10^{-9} cm/s for marine shale (Freeze and Cherry 1979) and a porosity of 0.06 (Morris and Johnson 1967). This travel time estimate would be verified by site characterization if this site were selected as the off-site alternative. Because there are no sole-source aquifers in the area within reasonable range of impact of the proposed disposal cell, the potential for adverse impacts to ground water would be further limited.

4.3.3.2 Construction and Operations Impacts Related to Transportation

Potential impacts to ground water associated with transportation would be limited to the slurry pipeline. There is a possibility that a line could break or leak. However, because of engineering controls for the pipeline (see Section 2.2.4.3), little potential exists for a spill to reach ground water at depths ranging from 100 to 300 ft (the closest depths to ground water along the entire route).

4.3.3.3 Impacts from All Sources

No impacts to ground water are expected at the Crescent Junction site. Ground water impacts that would occur at the Moab site from off-site disposal are discussed in Section 4.2.3.

4.3.4 Surface Water

Impacts to surface water from construction and operations at the Moab site would be similar to those described in Section 4.2.4. At the Crescent Junction site, there would be no impacts to surface water as a result of construction and operations or monitoring and maintenance. Approximately 100 ft of buried pipeline would be placed within ephemeral stream crossings under this alternative. Transportation-related impacts would be limited to the potential for short-term surface disturbance as a result of construction through ephemeral washes and to spills that could occur. However, the potential for short-term adverse effects would be limited with well-planned routing and site control measures as described in Chapter 2.0.

4.3.5 Floodplains/Wetlands

Construction and operations impacts that would occur to floodplains and wetlands at the Moab site from off-site disposal would be very similar to those described in Section 4.2.5.

4.3.5.1 Construction and Operations Impacts at the Crescent Junction Site

Because the Crescent Junction site would be located outside of the flood-prone areas of Crescent Wash and Crooked Wash, the likelihood of the proposed disposal cell location being affected by floodwaters is very low. The potential exists for construction of the disposal cell to increase sedimentation during a storm in the Crescent Wash drainage. However, site storm water controls would minimize the potential for any short-term impacts to Crescent Wash. No long-term impacts would be expected because no modifications would remain in the drainage following completion of remediation. There would be no impacts to wetlands because none are known to exist in the area.

4.3.5.2 Construction and Operations Impacts Related to Transportation

No wetland areas are known to exist along the proposed transportation routes, but the area would be investigated prior to construction. Potential impacts to ephemeral washes and any associated wetlands would be short term as a result of construction or upgrading roads, rail spurs, or the pipeline. Affected areas would be restored, avoiding any adverse long-term impact.

4.3.5.3 Impacts from All Sources

No long-term effects would be expected under the Crescent Junction off-site disposal alternative. Short-term impacts to Crescent Wash and wetlands, if they exist, would occur along proposed transportation routes.

4.3.6 Aquatic Ecology

Under this alternative, the short-term physical impacts to aquatic biota and habitats, including federally listed species, at the Moab site associated with construction and operations from off-site disposal would be very similar to those described in Section 4.2.6. Chemical and radiological impacts to aquatic resources would also be similar to those described in Section 4.2.6. Because there are no perennial surface waters at the Crescent Junction site, no adverse impacts to aquatic ecology would occur as a result of construction and operations, monitoring and maintenance activities, or transportation at that site. Therefore, these issues are not discussed further.

4.3.7 Terrestrial Ecology

Under this alternative, the physical, chemical, and radiological impacts to terrestrial species and habitats associated with construction and operations at the Moab site would be very similar to those described for on-site disposal (Section 4.1). Appendix A1, "Biological Assessment," presents a detailed discussion of potential effects on federally listed species at the Crescent Junction site.

4.3.7.1 Construction and Operations Impacts at the Crescent Junction Site

Construction of a disposal cell and ancillary support facilities would disturb up to 435 acres at the Crescent Junction site. The impacts of physical disturbance would include the short-term loss of cover, foraging, and breeding habitat in construction areas. In the long term, the area occupied by the disposal cell would result in a permanent loss of habitat. Species with small home ranges

would be displaced. However, species with larger home ranges would not be expected to be adversely affected.

The black-footed ferret is the only federally listed species that could potentially be affected by habitat disturbance resulting from construction of a disposal cell. The white-tailed prairie dog, upon which the black-footed ferret depends, is the only species currently in review for federal listing that could be so affected. All black-footed ferrets currently in the wild are believed to be the result of a federal reintroduction program. It is highly unlikely that the black-footed ferrets reintroduced in Uinta and Duchesne counties in 1999 or their offspring could occur on or near the Crescent Junction disposal site, although UDWR (2003) reported an unconfirmed sighting in the area in 1989. Consequently, no impacts from construction to the black-footed ferret would be anticipated.

Numerous white-tailed prairie dog colonies ranging in size from 10 acres to 2,445 acres occur around the Crescent Junction area (Seglund 2004). It is unknown to what extent individual colonies or a combination of colonies could support black-footed ferrets. Prior to development of the Crescent Junction disposal site, the area would be surveyed and the potential effects to white-tailed prairie dogs evaluated. In addition, the potential of such colonies to support black-footed ferrets would also be evaluated simultaneously.

Noise due to construction and operations could have an adverse effect on terrestrial wildlife. At the Crescent Junction site, noise would be generated by construction equipment and material transfer operations. It is estimated that the maximum noise levels that would be generated when all equipment was operating would be approximately 95 dBA measured at 49 ft. This noise level would attenuate over a distance of approximately 6 miles until it reached the quiet desert background level of approximately 30 dBA.

Noise can affect terrestrial organisms by causing physiological changes or behavioral modifications, including nest abandonment. It can also disrupt communication and defense systems. Any of the species that may be present at the site could be affected by the noise associated with construction and operations. Some of these, such as burrowing owls and prairie dogs, are frequently found near human activities and may thus be more likely to habituate to noise above background levels.

The Utah Gap Analysis (UDWR 1999) indicates that potential high-quality bald eagle wintering habitat exists throughout many of the project areas. The bald eagle is the only federally listed species in the vicinity of the Crescent Junction site that could be affected by noise from site operations. However, it is not known to nest or night roost in the area, nor is it commonly seen in the area, and it would therefore be unlikely to be affected.

Other effects of human presence, including night lighting, also would reduce the overall habitat value of the area. As with noise, some species become habituated to human presence, but others, such as deer or pronghorn antelope, could avoid the site during human activities. The site is surrounded by many square miles of similar habitat. Therefore, individuals that avoided the vicinity of construction activities would not be forced into less desirable habitat.

The effects of noise, supplemental lighting, and human presence could be greater at night than during the day. Therefore, double-shift operations would likely have a greater impact than single-shift operations. The effects of noise, supplemental lighting, and human presence could be

mitigated by limiting the amount of light off the site, minimizing activities at the periphery of the site, and limiting especially loud activities to daylight hours and to seasons when the effects on biota would be reduced. There would not likely be chemical impacts at the site. Accidental spills of diesel, oil, or other materials would be quickly controlled and mitigated.

Other species of interest, if present, that could be affected by construction of a disposal cell and the associated types of disturbance discussed above, include the burrowing owl, Swainson's hawk, ferruginous hawk, and peregrine falcon. Mexican spotted owls were historically reported to occupy the Book Cliffs to the north of the site but have not been observed in the vicinity recently (USF&WS 1995).

Development of the site for a disposal cell would reduce the amount of habitat available for white-tailed prairie dogs but likely would not affect the overall local population. In the short term, avian species (e.g., raptors) could be affected by loss of foraging habitat. Birds that may nest in the area (e.g., burrowing owl and ferruginous hawk) could be displaced during construction activities. However, it is unlikely that population abundance and distribution of these species would be adversely affected in the long term.

Short-term impacts of physical disturbance could be avoided or minimized in several ways. The most important action would be to conduct site-specific investigations prior to site development activities to determine the presence of any species of concern. Additional actions would include minimizing site disturbance to the extent practical, revegetating disturbed lands and the cover cap once it was completed, and scheduling ground-clearing activities during periods that would not disturb nesting migratory birds.

There would not likely be chemical or radiological impacts at the Crescent Junction site. Accidental spills of diesel, oil, or other materials could be quickly controlled and mitigated.

4.3.7.2 Impacts of Transportation

The effects to terrestrial species and habitats of transporting the tailings to the Crescent Junction site would depend on the transportation option selected. In the short term, truck transport could increase collision mortality and noise, rail transport could increase noise, and a slurry pipeline would disturb more habitat in the pipeline corridor.

Much of the transport of borrow materials would occur on lower-speed access roads rather than US-191. This could result in a lower rate of wildlife-vehicle collisions and less noise due to truck transport of borrow materials compared to transporting the materials from more distant borrow sites.

Truck Transportation Option

There is the potential for greater mortality for species, including the bighorn sheep, that frequent the US-191 corridor. Other species potentially affected include mule deer and pronghorn antelope. Small mammals, reptiles, and possibly birds would also suffer increased highway mortality rates. However, it is unlikely that the regional populations of any wildlife species, with the possible exception of the bighorn sheep, would be affected by this increased traffic mortality rate.

The bald eagle is the only federally listed species that could incur an increase in traffic-related mortality. The Utah Gap Analysis (UDWR 1999) indicates that potential high-quality bald eagle wintering habitat exists throughout many of the project areas. Bald eagles could be found temporarily and infrequently using such areas when there are opportunities to feed on carrion, such as in big-game wintering areas or in prairie dog colonies. Therefore, it is possible that if traffic-related wildlife mortality increased because of the project, an increased number of eagles could be hit on highways. However, without data on this relationship, it is reasonable to assume that the number of eagles hit on highways would be proportional to the number of carrion available. The increase in the number of traffic-related wildlife mortalities is expected to be small. Consequently, the potential increase in associated eagle deaths is also expected to be small.

The increased truck traffic along US-191 resulting from transport of tailings from the Moab site to the Crescent Junction site would likely increase ambient noise levels by approximately 5 dB (measured at 49 ft). However, no adverse effect to terrestrial wildlife is anticipated.

The primary federally listed species that could be affected by this increased traffic noise would be the Mexican spotted owl. Data provided by UDWR (2003) indicated that there were no occurrences of the Mexican spotted owl in any of the project areas. However, habitat models (BLM 2003) indicate that potential habitat areas may exist in the canyons near US-191 over the first 7 miles north from the Moab tailings pile. Nonetheless, these models are primarily based on physical and topographic features and do not consider vegetation requirements. Mexican spotted owls nest, roost, and forage in an array of different community types, but mixed-conifer forests dominated by Douglas fir and/or white fir are most common (USF&WS 1995). However, they may also nest, but less frequently, in arid, rocky, mostly unvegetated canyons (Romin 2004). Although there are no forested areas in the vicinity of US-191 north of Moab, there are arid canyons that largely or altogether lack forest-type vegetation. Thus, it is unlikely but possible that spotted owls occur in the canyons near US-191 over the first 7 miles north of the Moab site. If present, the species could be disturbed by noise from increased truck traffic. The area around this section of transportation corridor is a popular recreation area, with heavy use by off-highway vehicles and mountain bikes. Although the increase in truck traffic noise could be detectable up to several miles from the highway, the existing off-road vehicle noise and associated human presence would likely have a greater and more direct impact on the owls.

The potential for impacts to terrestrial wildlife from truck transportation of tailings would be greater in the evening or at night than during the day. Therefore, double-shift operations would probably have a greater potential for adverse impacts than single-shift operations. In either case, the impacts would be of relatively short duration and would cease once the transfer of materials to the disposal cell was completed.

Rail Transportation Option

Rail transportation of tailings from the Moab site to the Crescent Junction site would result in less frequent but potentially higher intermittent noise and ground vibration levels compared to the truck transportation option. Some wildlife species could be sensitive to noise from the rail system. However, because of the degree of off-road recreational activity in the area, as well as nearly 3,000 cars and trucks per day on US-191, most of the wildlife in the area would likely be somewhat habituated to human presence and noise. The potential collision-mortality rate would be lower using rail transport than truck transport.

Slurry Pipeline Option

Use of a slurry pipeline system to transport tailings material from the Moab site to the Crescent Junction site would result in a greater amount of short-term surface disturbance compared to the other two transportation modes.

Because much of the proposed pipeline route would be within, parallel to, or adjacent to either US-191or the Williams Gas pipeline rights-of-way, construction impacts would be expected to be minimal. However, some previously undisturbed habitat would be removed in the short term. Installation of the pipeline system could disturb species such as the Mexican spotted owl, white-tailed prairie dog, black-footed ferret, and species of ground-nesting migratory birds. Such impacts could be managed by performing site-specific investigations prior to pipeline construction to identify populations of these species of concern, adjusting the pipeline location if needed, and constructing the pipeline during periods of the year that would not disrupt nesting. Operation of the pipeline would not be expected to have any adverse effects on wildlife or habitat under the Crescent Junction off-site disposal alternative.

4.3.7.3 Monitoring and Maintenance Impacts

Routine post-closure monitoring and maintenance of a disposal cell at the Crescent Junction site would not be expected to affect terrestrial species or habitats. If major corrective actions were needed, some of the recovering vegetation on and around the disposal site could be disturbed.

4.3.7.4 Impacts from All Sources

Overall impacts to terrestrial ecological resources under the Crescent Junction off-site disposal alternative would include approximately 50 acres of tamarisk habitat lost at the Moab site (the rest of the site has a habitat value of zero), a maximum of approximately 690 acres of desert habitat at the borrow sites, 420 to 435 acres for construction of the disposal cell, and varying additional acreage depending on the mode of transportation.

Total maximum habitat disturbance for truck or rail transportation options from all activities (Moab site, borrow areas, transportation, and Crescent Junction site) would be approximately 1,175–1,235 acres. If the slurry pipeline option were selected, 164 acres of habitat could be disturbed for the pipeline corridor and 11 for support roads, bringing the total maximum habitat disturbance from all activities to approximately 1,345 acres.

Additional habitat would be lost at the commercial quarry sites for sand, gravel, and riprap. There would be a slight decrease in habitat value near US-191 if the truck transport option were selected because of the increased truck traffic required to haul tailings materials, and there would be a slight increase in traffic-related wildlife mortalities. Rail transport of tailings materials would slightly increase average noise levels along the rail route. Impacts of borrow material haulage would be less than under the on-site disposal alternative because the cover materials would be available near the disposal cell site (all other materials would require longer-distance transport), and haulage of these materials at highway speeds on US-191 would not be required.

4.3.8 Land Use

The land use impacts at the Moab site under the Crescent Junction off-site disposal alternative would be the same as those described in Section 4.2.8.

4.3.8.1 Construction and Operations Impacts at the Crescent Junction Site

Approximately 420 to 435 acres needed in the long term for the cell construction area would be withdrawn from BLM administration and transferred to DOE in perpetuity. All surface and subsurface land uses would be vested with DOE. These lands would be removed from the Crescent Canyon grazing allotment (1.9-percent reduction). Oil and gas leases would be terminated. Affected permittees and lessees would be compensated for lost grazing and oil and gas rights. The disposal cell would also result in long-term loss of all surface uses and leasing and mineral extraction in perpetuity on the withdrawn acreage and would result in a long-term loss of revenue for BLM for any surface or subsurface permits or leases on the site.

4.3.8.2 Construction and Operations Impacts Related to Transportation

The three options for transportation to the Crescent Junction site would likely result in restricted use of lands occupied by transportation infrastructure in the short term. For the rail haul option, approximately 57 acres would be temporarily dedicated to a new rail spur and a transfer station, which would be removed and reclaimed once tailings transport was completed. The slurry pipeline would be constructed predominantly in existing rights-of-way. Impacts to lands required for the transfer station, the slurry pipeline receiving facility, and the slurry pipeline would also be short term; these lands would be returned to their previous use once transportation of tailings was completed. Long-term land use (up to 13 acres) would be required for a permanent access road constructed from CR-223 to the disposal site under the truck transportation option.

4.3.8.3 Monitoring and Maintenance Impacts

The Crescent Junction site would be transferred to DOE, so there would be no additional impacts from monitoring and maintenance at the site. If monitoring locations were required outside DOE's property, lands required for wells or other monitoring equipment and the associated access would be negotiated and maintained.

4.3.8.4 Impacts from All Sources

Land use impacts at the Moab site would be similar to those described in Section 4.2.8. In addition, long-term land use impacts would occur at the Crescent Junction site for the cell and for the permanent access road to the site. The land use impacts associated with the rail spur, the transfer station required for the rail haul, the slurry receiving facility, and the slurry pipeline itself would be short term because these transportation modes and associated infrastructure would be reclaimed and returned to BLM for prior designated land use. There would be no impacts for borrow materials procured from commercial facilities. Of the total potential land use disturbance at the Crescent Junction site, approximately 420–435 acres for cell construction and up to 13 acres for dedicated access roads would remain under DOE ownership in perpetuity. DOE is deferring decisions regarding future uses and ownership of the 439-acre Moab site pending a determination of the success of remediation activities.

4.3.9 Cultural Resources

This section addresses the potential for the disturbance of known cultural resources or the discovery of unknown resources under the Crescent Junction off-site disposal alternative.

4.3.9.1 Construction and Operations at the Moab Site

Construction and operations impacts at the Moab site would be the same as those described in Section 4.1.9.1.

4.3.9.2 Construction and Operations Impacts at the Crescent Junction Site

On the basis of current estimates in Chapter 3.0, one to two cultural sites eligible for inclusion in the National Register of Historic Places could be adversely affected by construction and operations at the Crescent Junction site. The Class III cultural resource survey that DOE would conduct at the Crescent Junction site would indicate the precise number and types of cultural sites present. Along with the Class III survey, DOE would conduct a site-specific study to identify potential traditional cultural properties that may exist on the site (there is a low to medium likelihood that they would occur). DOE, BLM, the State Historic Preservation Officer, affected Native American tribes, and the Advisory Council on Historic Preservation would determine appropriate mitigation measures through the Section 106 consultation process (see Section 3.1.13.3). Mitigation measures might include (1) avoiding the cultural resource sites, (2) monitoring the cultural resource during surface-disturbing activities, (3) excavating and recording cultural resource data before construction activities began, or (4) moving the cultural resource objects from areas of disturbance to nearby undisturbed areas.

Cultural resources located near areas of disturbance could be adversely affected indirectly (through illicit collection, vandalism, or inadvertent destruction) as a result of increased human activity in the area. DOE would require site workers to receive training on the need for cultural resource protection and the legal consequences of disturbing cultural resources.

4.3.9.3 Construction and Operations Impacts Related to Transportation

Because of the expected low density of cultural sites, construction of the infrastructure needed for the truck and rail alternatives would not be expected to adversely affect cultural resources at or near the Crescent Junction site. One cultural site—the historic US-160 that parallels US-191—could be adversely affected by construction of a highway overpass and acceleration lane at the Moab site under the truck option.

A total of 45 cultural sites eligible for inclusion in the National Register of Historic Places are known to exist within 0.5-mile of the proposed slurry pipeline route to the Crescent Junction site. Of these, 11 to 25 could be adversely affected during pipeline construction. The potential for traditional cultural properties to occur along the pipeline route is low to high. If these properties were located along the route, they most likely would be adversely affected as well. DOE, BLM, UDOT, the State Historic Preservation Officer, affected Native American tribes, and the Advisory Council on Historic Preservation would determine appropriate mitigation measures for these sites through the Section 106 consultation process.

In addition to these direct impacts, cultural resources located near the pipeline could be adversely affected indirectly (through illicit collection, vandalism, or inadvertent destruction) as a result of increased human activity in the area.

4.3.9.4 Monitoring and Maintenance Impacts

Monitoring and maintenance at the Crescent Junction site would have no effect on cultural resources.

4.3.9.5 Impacts from All Sources

Table 4–32 lists the total number of cultural sites eligible for inclusion in the National Register of Historic Places that could be adversely affected under each of the Crescent Junction transportation options.

Table 4–32. Number of Cultural Sites that Could Be Adversely Affected Under the Three Transportation Options

Location/Activity	Transportation Mode		
	Truck	Rail	Slurry Pipeline
Moab site (construction and operations)	0–2	0–2	0–2
Moab site (highway improvements)	1	0	0
Crescent Junction disposal cell area (including cover soil borrow area)	1–2	1–2	1–2
Radon barrier borrow area	3–7	3–7	3–7
Haul road for truck transport at Crescent Junction site	0	N/A	0
Rail infrastructure at Crescent Junction site	N/A	0	N/A
Pipeline construction	N/A	N/A	11–25[a]
Total	**5–12**	**4–11**	**15–36[a]**

[a]Numbers do not include potential traditional cultural properties that have not yet been identified along the pipeline route; the likelihood of their occurrence is low to high.

4.3.10 Noise and Vibration

This section addresses the impacts of noise and ground vibration primarily to human receptors. Where appropriate, impacts to wildlife and cultural resources are also identified. Unless otherwise indicated, all noise and vibration impacts would be temporary and would last only as long as project construction and operations were ongoing.

4.3.10.1 Construction and Operations Impacts at the Moab Site

Noise from the Moab site under the Crescent Junction off-site disposal alternative would come from construction activities and removal of the tailings pile. The largest sources of noise on the site would be heavy earth-moving equipment. The noise generated from these activities would not differ significantly from the noise generated at the Moab site under the on-site disposal alternative. Section 4.1.10 describes the noise associated with construction and earth-moving activities. A description of the noise generated by a conveyor system for the train transportation option is presented in Section 4.2.10.1.

Ground vibration generated by heavy equipment at the Moab site is discussed in Section 4.1.10. No appreciable differences would be expected in ground-level vibration between the on-site disposal alternative and the Crescent Junction off-site disposal alternative.

4.3.10.2 Construction and Operations Impacts at the Crescent Junction Site

Noise at the Crescent Junction site from the disposal of tailings would come from construction activities and movement of the tailings. The type of noise generated from these activities and the region of influence around the site are described in Section 4.2.10.2 for the Klondike Flats site. No appreciable differences would be expected in the source or levels of noise. However, the receptors around Crescent Junction would be different from those around the Klondike Flats site. A gas station and several (one to five) residents are located approximately 2,620 ft south of the Crescent Junction site. These receptors are beyond the estimated 1,480-ft region of influence that would exceed the 65-dBA residential standard for the City of Moab (Moab City Ordinance 17.74.080, "Noise Levels").

Ground vibration generated from construction and operations at the Crescent Junction site would be the same as those discussed in Section 4.2.10.2. There are no receptors at the Crescent Junction site within the 820 ft estimated for ground vibration to attenuate to background levels.

4.3.10.3 Construction and Operations Impacts Related to Transportation

Noise from transportation of material from the Moab site to the Crescent Junction site would originate from truck traffic, rail traffic, or construction of a slurry pipeline. A description of the noise generated from these activities and the region of influence around the transportation routes is included in Section 4.2.10.3. No appreciable differences would be expected in the source or levels of noise. However, the receptors around Crescent Junction would be different from those around the Klondike Flats site. For the truck haul alternative, noise levels at the gas station and residences could exceed the 65-dBA residential standard for the City of Moab (Moab City Ordinance 17.74.080, "Noise Levels"). The exact location of these buildings relative to the transportation route is not known. The region of influence around the transportation route expected to exceed 65 dBA is 430 ft. The increase in noise caused by truck-hauling activity would be estimated to be 4 dBA (1-hour L_{eq}). The actual increase could be less, depending on truck speed on the highway overpass.

Construction of a slurry pipeline would likely result in ground vibration above background levels within Arches National Park. The estimated maximum level for ground vibration produced during construction of a slurry pipeline would be 95 dBV. This level would result in ground vibration above background levels 820 ft from the source and levels above human perception within 330 ft of the source. Some cultural sites containing rock structures and the historic rock bridge at Arches National Park would be within 2,620 ft of the pipeline, but ground vibration levels would not reach levels (estimated at 92 to 100 dBV) that would damage these structures.

4.3.10.4 Monitoring and Maintenance Impacts

Monitoring and maintenance of the Crescent Junction site would not be expected to result in significant generation of noise. Any noise generated by these activities would attenuate to near background levels before leaving the site boundary.

4.3.10.5 Impacts from All Sources

Noise generated under the Crescent Junction off-site disposal alternative would not exceed the Moab residential noise standard of 65 dBA at any receptor locations. The receptors with the most potential to notice any increase in noise generated by this alternative include the resident located on the eastern boundary of the site, visitors at Arches National Park, and residents near the gas station at Crescent Junction. If two 10-hour shifts were used instead of a single 12-hour shift, the noise generated would not change substantially, but there could be a higher potential for annoyance from late-night and early-morning activities.

4.3.11 Visual Resources

This section describes the impacts to those physical features of the landscape that impart scenic value in the region affected by this alternative. The impacts would be imposed on viewers who live in, work in, or visit an area and can see ongoing human activities or the results of those activities. Construction and operations impacts to visual resources at the Moab site would be the same as those described in Section 4.2.11.1. No impacts to visual resources would occur from monitoring and maintenance activities under this alternative. Therefore, these activities are not addressed further.

4.3.11.1 Construction and Operations at the Crescent Junction Site

Construction and operations at the Crescent Junction site would have moderate adverse effects on visual resources, primarily because construction activities and the completed disposal cell would be viewed by a large number of travelers on I-70. DOE selected five key observation points from which to assess visual impacts: (1) western Thompson Springs residences, (2) Crescent Junction residences, (3) I-70 westbound, (4) I-70 eastbound, and (5) I-70 scenic overlook. Figure 4–13 shows DOE's visibility analysis results for a proposed disposal cell at the Crescent Junction site. The darkened areas indicate locations from which a disposal cell could potentially be viewed. The visibility analysis used to create this map is based on elevation and topography. It does not take into account the potential obstruction of views from cultural modifications or vegetation or the effects of distance on visibility. Without visual aids, such as binoculars, most people would not be able to recognize a disposal cell at distances greater than 5 to 10 miles.

The visibility analysis results indicate that residents of Thompson Springs and Crescent Junction, travelers on I-70, and visitors to the I-70 scenic overlook would be able to view the Crescent Junction disposal cell. Given the distance from the disposal cell and viewing angle, residents in western Thompson Springs would not likely be able to view construction activities during the construction period. They would, however, likely notice dust during daylight hours and light during dawn and dusk (and at nighttime under a double-shift work scenario). Neither dust nor light would be visible after construction was completed, as no dust-producing activities would occur, and no lighting would remain at the site. Residents would not be able to see much of the completed disposal cell. The cell would appear as a thin, grayish-beige sliver of earth for 3 to 5 years after completion; contrasts with the surrounding buff-colored landscape would be weak. After the cell was revegetated, it would not be noticeable.

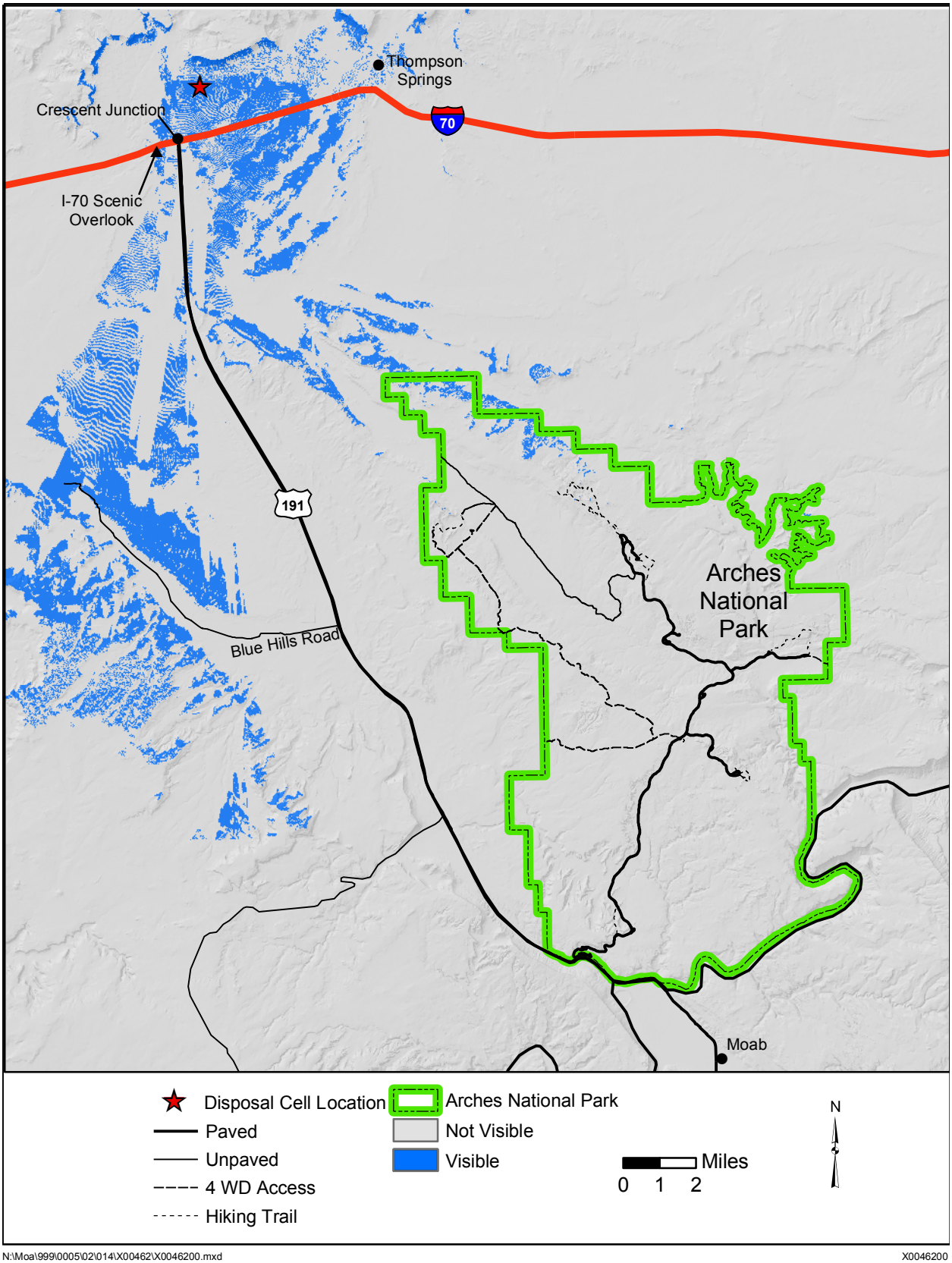

Figure 4–13. Crescent Junction Site Visibility Analysis Map

Views of construction activities and the completed disposal cell from residences (four mobile homes, two of which are unoccupied, and one house) in Crescent Junction would be obstructed primarily by the railroad grade located between the homes and the cell and secondarily by the foliage of cottonwood and Siberian elm trees. Like the residents in Thompson Springs, residents of the Crescent Junction homes would likely see dust during daylight hours and light during dawn and dusk (and at nighttime under a double-shift work scenario). These visual impacts would not occur after disposal cell construction was completed.

Travelers would have a clear view of the completed disposal cell from both the westbound and eastbound lanes of I-70. Viewing times from both lanes would be approximately 3 minutes for the driver and 3.5 minutes for passengers. Because of the 1-mile distance to the disposal cell and the viewing angle from the freeway, travelers may or may not notice construction activities. The disposal cell itself would create a weak to moderate contrast with the surrounding landscape. Relative to the steep, dissected cliffs of the 1,000-ft-high Book Cliffs, the 30-ft-high disposal cell would appear as a light-gray, slender, linear form (see Figure 4–14). The cell could be camouflaged somewhat by the linear railroad grade located between the observers and the cell. After 3 to 5 years, shrubby vegetation on the light-gray side slopes would camouflage the color and linearity of the cell even more, lessening the potential visual contrast (Figure 4–15).

Figure 4–14. Simulated View of the Crescent Junction Disposal Cell from the Westbound Lane of I-70 Immediately After Construction

Figure 4–15. Simulated View of the Crescent Junction Disposal Cell from the Westbound Lane of I-70 After Vegetation Was Established

For visitors at the I-70 scenic overlook, the completed disposal cell would create a moderate to strong contrast with the surrounding landscape. The higher viewing angle from this location would allow observers to view the top and side slopes of the cell. Viewing time would be approximately 5 to 10 minutes. Before the cell was revegetated, its simple, barren, geometric form and relatively bright surface would contrast moderately to strongly with the more complex, vertical form of the Book Cliffs and the adjacent, vegetated desert plain (Figure 4–16). After vegetation was established, the simple, rectangular form would be camouflaged somewhat by shrubs and would create a weak to moderate contrast with the adjacent desert plain (Figure 4–17).

From all but the I-70 scenic overlook key observation point, DOE's proposed action at the Crescent Junction site would be compatible with BLM's Class III visual resource objectives for this area, as the Class III designation allows an activity to attract, but not dominate, the attention of casual observers (BLM 2003). Class III objectives would be met from the I-70 scenic overlook after vegetation was established on the cell.

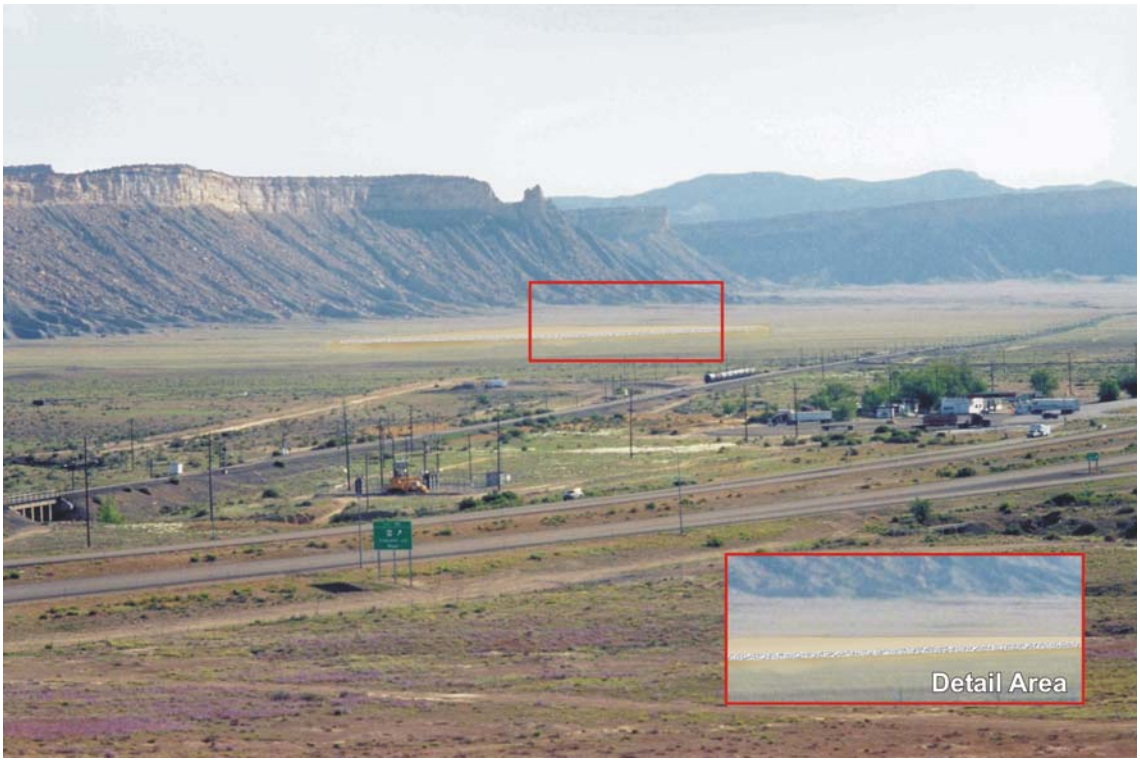

Figure 4–16. Simulated View of the Crescent Junction Disposal Cell from the I-70 Scenic Overlook Immediately After Construction

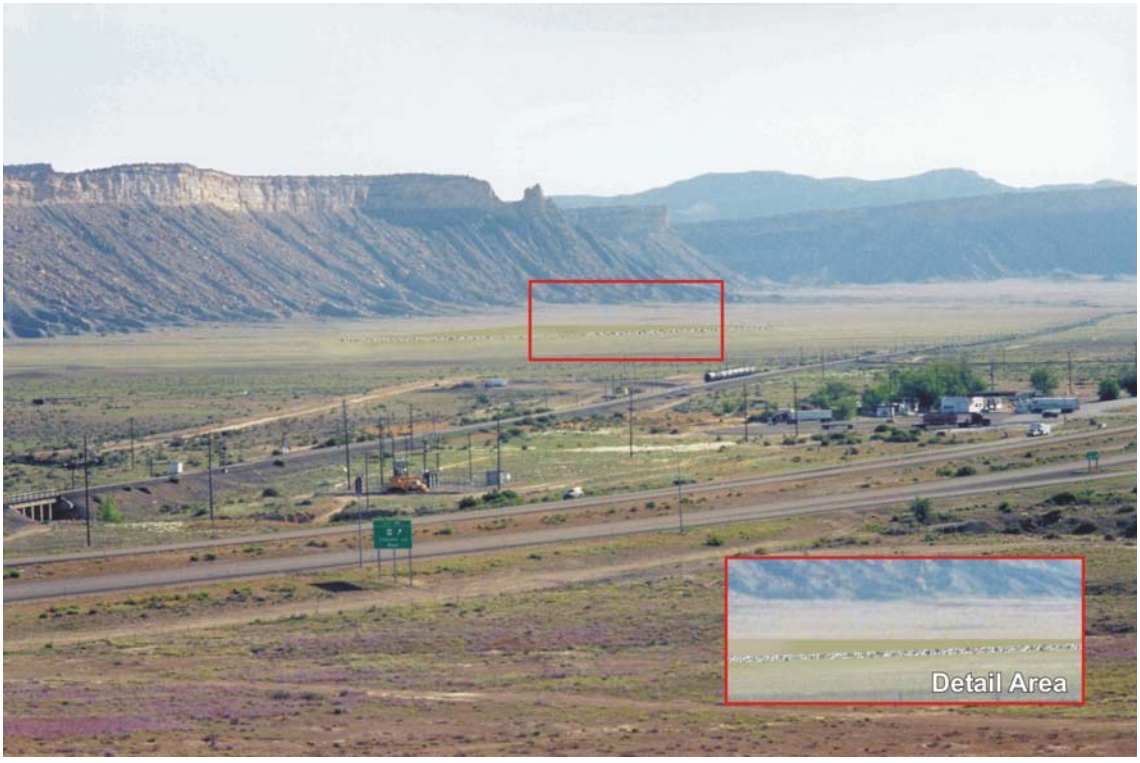

Figure 4–17. Simulated View of the Crescent Junction Disposal Cell from the I-70 Scenic Overlook After Vegetation Was Established

4.3.11.2 Construction and Operations Impacts Related to Transportation

Truck Haul

Construction of a 2.5-mile access road from Crescent Junction to the proposed disposal cell site under the truck haul option would have negligible impacts to visual resources. From all key observation points, the linear feature would contrast weakly with the natural surroundings and existing linear features (US-191, CR-175, railroad grade, I-70) in the area. Most travelers would not notice the road. Travelers at the I-70 scenic overlook and local residents would likely notice the haul truck traffic on the access road. DOE estimates that, on average, approximately 28 trucks per hour would use US-191 and the access road to transport tailings, vicinity property, and borrow materials during the 3 to 5 years of operations. Given the proximity to I-70 traffic and traffic associated with the Crescent Junction store and gas station, the adverse visual impact from the additional movement and dust would be negligible to moderate. Overall, this transportation option would be compatible with BLM's Class III visual resource objectives.

Rail Haul

The newly constructed railroad spur would not be visible from any of the key observation points, with the exception of the I-70 scenic overlook. This feature by itself would not draw the attention of most observers, as it is a feature commonly found along highways. Because of distance and viewing angles, the train/truck transfer station constructed on the Crescent Junction site might be noticed but would not dominate the views from any of the key observation points. Travelers at the I-70 scenic overlook and local residents would likely notice the haul truck traffic between the transfer station and disposal cell. Potentially, approximately 29 trucks per hour could be transporting tailings and borrow materials on the access road during the 3 to 5 years of disposal cell construction at the Crescent Junction site. Given the proximity to I-70 traffic and traffic associated with the Crescent Junction store and gas station, the adverse visual impact from the additional movement and dust would be negligible to moderate. Once the disposal cell was completed, haul truck traffic would cease, the transfer station would be dismantled, and the station area would be reclaimed with native species. After 3 to 5 years of vegetation growth, the visual impact would be eliminated. This transportation option would be compatible with BLM's Class III visual resource objectives.

Slurry Pipeline

Visual impacts from construction of a slurry pipeline between Moab and the Klondike Flats portion of the pipeline are described in Section 4.2.11.3. Between the Klondike Flats and Crescent Junction portion of the pipeline, approximately 3 miles of the corridor immediately north of the Klondike Flats site would be visible to travelers on US-191. In this 3-mile section, the smooth, linear, unvegetated swath created by pipeline construction would contrast moderately with the surrounding features, characterized primarily by light-beige and light-gray, rolling desert plains and smooth, rounded, buff-colored bluffs. After the pipeline was removed and the corridor revegetated, the contrast between the corridor and surrounding landscape would be moderate to nonexistent, depending upon the success of revegetation.

North of the 3-mile section visible to travelers, the corridor would veer off to the northeast along an existing pipeline route and would not be visible to the general public until it crossed I-70 near the town of Crescent Junction. Most travelers would not notice either a barren or vegetated

pipeline corridor that crossed beneath the freeway because of their travel speed and the presence of a number of other linear features (I-70, US-191, CR-175, railroad grade) in the area. The visual impacts associated with construction and revegetation of the pipeline would be compatible with BLM's Class III and IV objectives for this area.

4.3.11.3 Impacts from All Sources

Moving the tailings pile from the Moab site to the Crescent Junction site would have some moderate, short-term, adverse visual impacts and moderate to no long-term adverse visual impacts, primarily because the short-term construction activities and the completed disposal cell would not be seen by many people. At the Moab site, removal of the pile would have strong beneficial impacts to visual resources. Table 4–33 summarizes visual resource impacts expected to occur under this alternative.

Table 4–33. Summary of Visual Resource Impacts Under the Crescent Junction Off-Site Disposal Alternative

Location/Activity	Visual Resource Impacts	
	Short-Term	Long-Term
Moab site	Strong adverse impacts primarily to travelers on US-191 and SR-279	Strong positive impacts from removal of tailings pile
Crescent Junction disposal site	Weak to strong adverse impacts, depending upon viewing location	Moderate to no adverse impacts, depending upon viewing location
Cover soil borrow area	Negligible to strong adverse impacts, depending upon borrow source	No adverse impacts
Truck haul[a]	Negligible to moderate adverse impacts	No adverse impacts
Rail haul[a]	Negligible to moderate adverse impacts	No adverse impacts
Slurry pipeline[a]	Moderate adverse impacts to travelers on US-191	Moderate to no adverse impacts to travelers on US-191
Monitoring and maintenance	No adverse impacts	No adverse impacts

[a]Only one transportation option would be selected.

4.3.12 Infrastructure

This section addresses potential impacts on the availability of electric power, potable water, nonpotable water, sewage treatment, rail service, and highways. Unless otherwise indicated, all infrastructure impacts would be temporary and would last only as long as project construction and operations were ongoing.

4.3.12.1 Construction and Operations Impacts at the Moab Site

The infrastructure impacts associated with construction and operations at the Moab site would be the same as those described for the truck and rail options in Section 4.2.12.1. For the slurry pipeline option, electric power demand would be 4,800 kVA, 1,400 kVA more than under the Klondike Flats off-site disposal alternative.

4.3.12.2 Construction and Operations Impacts at the Crescent Junction Site

The infrastructure impacts associated with construction and operations at the Crescent Junction site would be the same as those described in Section 4.2.12.2 for construction and operations at the Klondike Flats site, with the exception of electric power demands. The impact on the existing electrical infrastructure servicing the Crescent Junction disposal cell area would differ for the

three alternative modes of transportation. For truck transportation, the total power demand would be 300 kVA; for rail transportation, the total power demand would be 600 kVA. Both of these options would require the same demand as for the Klondike Flats site. For slurry pipeline transportation, however, the demand would be 2,800 kVA, 300 kVA more than for the Klondike Flats site. ESC of Fort Collins, Colorado, developed and reviewed this projected demand with Mathew Yates, Pacific Corporation, Moab. Pacific Corporation indicated that this demand would present no capacity problems to the existing electric supply system at the site, nor would system upgrades be required (ESC 2003).

4.3.12.3 Construction and Operations Impacts Related to Transportation

Infrastructure impacts associated with transportation would be qualitatively similar to those described in Section 4.2.12.3 for the Klondike Flats site. Quantitatively, there would be an increased incremental electric power demand. Overall site power requirements for Crescent Junction, including those for transportation-related operations, are presented in Chapter 2.0. The truck transportation mode would not entail additional power demands over the 300 kVA required for site construction and operations. However, the rail transportation mode would draw an additional 300 kVA (600 kVA total demand), and the slurry pump would draw an additional 2,500 kVA (2,800 kVA total demand).

4.3.12.4 Monitoring and Maintenance Impacts

Monitoring and maintenance activities would be generally limited to periodic inspections and activities to remedy incipient erosion as necessary. DOE does not expect these activities to affect the local or regional infrastructures.

4.3.12.5 Impacts from All Sources

Regional and local supplies of power, water, and sewage treatment capacity would be adequate to meet the requirements of the Crescent Junction off-site disposal alternative. Transportation would cause increased wear and tear on roads, which would be paid for through vehicle registration and special permit fees.

4.3.13 Solid Waste Management

The impacts of solid waste management under the Crescent Junction off-site disposal alternative would be identical to those described in Section 4.2.13 for the Klondike Flats off-site disposal alternative.

4.3.14 Socioeconomics

The socioeconomic impacts from off-site disposal at the Crescent Junction site would be similar in scope to those described in Section 4.2.14. Aggregate expenditures under this alternative would include construction and surface remediation at the Moab and Crescent Junction sites, ground water remediation, remediation of vicinity properties, and transportation of materials from the Moab site and vicinity properties to the Crescent Junction site. As described in Section 4.2.14, the aggregate impacts would depend on the mode of transportation used. The project cost data and economic impact estimation methodology are described in Section 4.1.14.

The economic impacts of off-site disposal at the Crescent Junction site are summarized in Table 4–34. The annual project costs over the 8-year disposal period are estimated to be $41,741,425 under the truck transport option. Under the rail transport option, the annual spending over the disposal period is estimated to be $49,423,275. The slurry pipeline transport option is expected to increase annual spending over the 8-year period by $50,258,588. Over the remaining 75-year ground water remediation/site monitoring period, the annual project costs are estimated to be $933,000 under each transportation option. The project spending would increase the final demand for the construction and transportation industries. Under the truck transport option, regional output of goods and services would increase by $55,006,850 a year. Under the rail transport and slurry pipeline options, the demand for goods and services would increase by $65,129,992 and $66,230,767, respectively. Project spending over the disposal period would also increase labor earnings and employment. Under the truck option, earnings and employment would rise by $13,565,963 and 431 direct and indirect jobs. The increase in labor earnings and employment would be $16,062,564 and 335 direct and indirect jobs under the rail option. Increased regional earnings under the slurry pipeline option would initially rise to $16,334,041 and 458 jobs during the first-year construction phase of the pipeline. Thereafter, earnings and employment would scale down to $15,097,007 and 315 jobs.

Table 4–34. Economic Impacts in the Two-County Socioeconomic Region of Influence Under the Crescent Junction Off-Site Disposal Alternative

Transport Method	Annual Cost	Annual Output of Goods and Services	Annual Labor Earnings	Jobs
Truck	$41,741,425	$55,006,850	$13,565,963	431
Rail	$49,423,275	$65,129,992	$16,062,564	335
Pipeline	$50,258,588	$66,230,767	Year 1 $16,334,041 Years 2–8 15,097,007	458 315

Note: Economic impacts for regional output of goods and services and labor earnings are calculated based on final-demand multipliers provided by the Bureau of Economic Analysis. The respective multiplier values (1.3178 and 0.3250) are multiplied by annualized cost to generate the impact values shown. Employment impacts are calculated as the product of the direct-effects multiplier (1.4262) and total direct jobs for each action alternative (see Tables 2−16, 2−17, and 2−18).

The potential shorter-term impacts under the Crescent Junction off-site disposal alternative would include increased demand for temporary housing (discussed in Section 4.1.14) and transportation-related inconveniences to motorists (discussed in Section 4.3.16). The extent of these shorter-term impacts would depend on levels of tourism-recreation activities and the mode of transportation used in the remediation process. Longer-term beneficial impacts from the off-site disposal alternative would relate to greater opportunities for economic development in the Moab area and greater diversification of the tax base (discussed in Section 4.1.14).

4.3.15 Human Health

This section addresses potential impacts to human health. These impacts are worker deaths that could occur as a result of industrial accidents and worker or public latent cancer fatalities that could occur as a result of exposure to radiation from activities at the Moab and Crescent Junction sites, at vicinity properties, or during transportation of materials.

4.3.15.1 Construction and Operations at the Moab Site and the Crescent Junction Site

Under the Crescent Junction off-site disposal alternative, construction activities would occur at vicinity properties, borrow areas, Crescent Junction, and at the Moab site. Table 4–35 lists the impacts from these activities. For each option under this alternative, less than one fatality would be estimated to occur from construction activities.

Table 4–35. Construction-Related Fatalities Under the Crescent Junction Off-Site Disposal Alternative

Alternative	Construction Fatalities
Truck Option	
Vicinity properties	0.031
Borrow areas	0.042
Moab and Crescent Junction activities	0.31
Total	**0.38**
Rail Option	
Vicinity properties	0.031
Borrow areas	0.037
Moab and Crescent Junction activities	0.32
Total	**0.39**
Slurry Option	
Vicinity Properties	0.031
Borrow areas	0.042
Moab and Crescent Junction activities	0.39
Total	**0.47**

Workers. Under the Crescent Junction off-site disposal alternative, workers would be exposed to radon gas (an inhalation hazard) and external radiation from the mill tailings at the Moab site, vicinity properties, and Crescent Junction. According to monitoring data collected during construction of an evaporation pond on the mill tailings pile, the highest radon level measured on the mill tailings pile was 0.096 working levels (21 pCi/L). A worker exposed to this level of radon for 2,000 hours per year would have a latent cancer fatality risk of 6.1×10^{-4} per year of exposure. The highest external gamma exposure rate measured on the mill tailings pile was about 0.60 mR/h. A worker exposed to this level of radiation for 2,000 hours per year would have a latent cancer fatality risk of 6.0×10^{-4} per year of exposure. The total latent cancer fatality risk to the worker on the mill tailings pile would be 1.2×10^{-3} per year of exposure (Table 4–36) or 6.0×10^{-3} over the 5-year duration of activities at the Moab site. Assuming that the radon and external radiation levels were comparable at the Crescent Junction site, this would also be the latent cancer fatality risk at the Crescent Junction site.

The Moab site would employ about 67 workers. If they were all exposed to radon and external radiation at the levels discussed for individual workers, the latent cancer fatality risk for this population of workers would be 0.081 per year of exposure, or 0.40 over the 5-year duration of activities at the Moab site. The Crescent Junction site would employ about 70 workers. If they were all exposed to radon and external radiation at the levels discussed for individual workers, the latent cancer fatality risk for this population of workers would be 0.085 per year of exposure, or 0.42 over the 5-year duration of activities at the Crescent Junction site.

Table 4–36. Worker Impacts Under the Crescent Junction Off-Site Disposal Alternative

Worker	Site	Radon Related LCFs[a,b]	External Radiation Related LCFs[a,b]	Total LCFs[a,b]
Annual				
Individual	Moab	6.1×10^{-4}	6.0×10^{-4}	1.2×10^{-3}
	Crescent Junction	6.1×10^{-4}	6.0×10^{-4}	1.2×10^{-3}
	Vicinity Properties	2.9×10^{-4}	1.2×10^{-4}	4.1×10^{-4}
Population	Moab	0.041	0.040	0.081
	Crescent Junction	0.043	0.042	0.085
	Vicinity Properties	6.7×10^{-3}	2.9×10^{-3}	9.6×10^{-3}
	Total	**0.091**	**0.085**	**0.18**
5-Year Duration of Activities				
Individual	Moab	3.0×10^{-3}	3.0×10^{-3}	6.0×10^{-3}
	Crescent Junction	3.0×10^{-3}	3.0×10^{-3}	6.0×10^{-3}
	Vicinity Properties	8.7×10^{-4}	3.7×10^{-4}	1.2×10^{-3}
Population	Moab	0.20	0.20	0.40
	Crescent Junction	0.21	0.21	0.42
	Vicinity Properties	0.020	8.6×10^{-3}	0.029
	Total	**0.43**	**0.42**	**0.85**

[a]Based on 67 workers at the Moab site, 70 workers at the Crescent Junction site, and 23 workers at vicinity property sites.
[b]LCF = latent cancer fatality.

Impacts to workers as a result of activities at the vicinity properties would be the same as under the on-site disposal alternative, as would be the lack of impacts from ground water treatment; these impacts are described in Section 4.1.15.2.

Under the Crescent Junction off-site disposal alternative, nearby residents would be exposed to radon gas released from the Moab site and at Crescent Junction. The average radium-226 content of the tailings, 516 pCi/g, would produce a latent cancer fatality risk for a nearby resident in Moab of 8.8×10^{-3} over the 5-year duration of activities at the Moab site and 7.5×10^{-5} over the 5-year duration of activities at the Crescent Junction site. These estimates include radon released from the drying areas in Moab. If a slurry pipeline were used to move the tailings to Crescent Junction, the drying areas would not be necessary, and the resulting latent cancer fatality risk for a nearby resident at Moab would be reduced to 6.9×10^{-3} over the 5-year duration of activities at Moab.

For the population, over the 5 years of activities at the Crescent Junction site, the latent cancer fatality risk to the population surrounding Crescent Junction would be 8.3×10^{-3}. Over the 5 years of activities at the Moab site, the latent cancer fatality risk to the population surrounding the Moab site would be 1.0. If a slurry pipeline were used to move the tailings to Crescent Junction, the drying areas would not be necessary, and the resulting latent cancer fatality risk for the population surrounding the Moab site would be reduced to 0.74 over the 5-year duration of activities at the Moab site.

Nearby residents would also be exposed to windblown radioactive particulates (e.g., radium-226, polonium-210, thorium-230, and uranium) from the Moab site and the Crescent Junction site. Estimates based on monitoring data collected during 1998 and 1999 from the Monticello mill

tailings site when uranium mill tailings were being excavated indicate that the latent cancer fatality risk from radioactive particulates would be about 0.1 percent of the risk from radon emissions from the Moab site and Crescent Junction site. This is due to the aggressive dust suppression practices that would be used to minimize emissions of radioactive particulates.

4.3.15.2 Construction and Operations Impacts Relating to Transportation

Under the Crescent Junction off-site disposal alternative, there would be a total of 292,888 shipments if trucks were used to move the tailings from the Moab site to the Crescent Junction site (Table 4–37). If rail were used, there would be a total of 30,116 shipments. If a slurry pipeline were used to move the tailings, there would be 26,276 shipments. These shipments would include contaminated material from vicinity properties, uranium mill tailings, and borrow material, which would consist of cover soils, radon and infiltration barrier soils, sand and gravel, riprap, and Moab site reclamation soils.

Table 4–37. Shipments Under the Crescent Junction Off-Site Disposal Alternative

Material	Truck Option		Rail Option		Slurry Pipeline Option	
	Shipments	Mode	Shipments	Mode	Shipments	Mode
Vicinity property material	2,940	Truck	2,940	Truck	2,940	Truck
Borrow material	21,148	Truck	21,148	Truck	21,148	Truck
Uranium mill tailings	268,800	Truck	3,840 2,188	Rail[a] Truck	2,188	Truck
Total	**292,888**		**30,116**		**26,276**	

[a]Each rail shipment would consist of 30 railcars of uranium mill tailings.

The transportation impacts of shipping contaminated materials from vicinity properties, mill tailings, and borrow material would be from two sources: radiological impacts and nonradiological impacts. Radiological impacts would be from incident-free transportation and from transportation accidents that released contaminated material. There would be no radiological impacts from moving borrow material because it is not contaminated. Nonradiological impacts would be from engine pollutants (emissions from the truck or train moving the contaminated materials from vicinity properties, mill tailings, and the borrow material) and from traffic fatalities. The total transportation impacts would be the sum of the radiological and nonradiological impacts. Additional details on these analyses are provided in Appendix H.

Table 4–38 lists the transportation impacts under the Crescent Junction off-site disposal alternative. For this alternative, there would less than one fatality. In comparison, about 40,000 traffic fatalities occur annually in the United States (U.S. Census Bureau 2000).

Workers. For truck shipments of mill tailings from the Moab site to Crescent Junction, the maximally exposed transportation worker would be the truck driver. This person was assumed to drive the truck containing mill tailings for 1,000 hours per year. For the other 1,000 hours per year, the truck would be empty. This driver would receive a radiation dose of 220 mrem/yr, which is equivalent to a probability of a latent cancer fatality of about 1.1×10^{-4}.

Table 4–38. Transportation Impacts Under the Crescent Junction Off-Site Disposal Alternative

Alternative	Radiological			Nonradiological		Total Fatalities
	Incident-Free		Accident Risk LCFs	Pollution Health Effects Fatalities	Traffic Fatalities	
	Public LCFs	Worker LCFs				
Truck Option						
Vicinity properties	2.7×10^{-5}	3.9×10^{-5}	6.9×10^{-9}	3.7×10^{-4}	1.1×10^{-3}	1.5×10^{-3}
Borrow material	0	0	0	8.9×10^{-4}	0.042	0.043
Mill tailings	2.7×10^{-3}	0.017	3.3×10^{-9}	1.6×10^{-4}	0.43	0.45
Total	**2.7×10^{-3}**	**0.017**	**1.0×10^{-8}**	**1.4×10^{-3}**	**0.47**	**0.49**
Rail Option						
Vicinity properties	2.7×10^{-5}	3.9×10^{-5}	6.9×10^{-9}	3.7×10^{-4}	1.1×10^{-3}	1.5×10^{-3}
Borrow material	0	0	0	8.9×10^{-4}	0.042	0.043
Mill tailings	2.7×10^{-5}	1.7×10^{-3}	6.5×10^{-9}	1.1×10^{-4}	0.29	0.29
Total	**5.4×10^{-5}**	**1.7×10^{-3}**	**1.3×10^{-8}**	**1.4×10^{-3}**	**0.33**	**0.33**
Slurry Option						
Vicinity properties	2.7×10^{-5}	3.9×10^{-5}	6.9×10^{-9}	3.7×10^{-4}	1.1×10^{-3}	1.5×10^{-3}
Borrow material	0	0	0	8.9×10^{-4}	0.042	0.043
Mill tailings	2.2×10^{-5}	1.4×10^{-4}	2.7×10^{-11}	1.3×10^{-6}	3.5×10^{-3}	3.7×10^{-3}
Total	**4.9×10^{-5}**	**1.8×10^{-4}**	**6.9×10^{-9}**	**1.3×10^{-3}**	**0.047**	**0.048**

LCF = latent cancer fatality.

For rail shipments of mill tailings from the Moab site to Crescent Junction, the maximally exposed transportation worker would be an individual who inspected the loading of the rail cars. This person would receive a radiation dose of 440 mrem/yr, which is equivalent to a probability of a latent cancer fatality of about 2.2×10^{-4}.

Public. For truck shipments of mill tailings from the Moab site to Crescent Junction, the maximally exposed member of the public would be a resident who lived along the road on which the tailings were shipped. This person would receive a radiation dose of 1.0 mrem/yr, which is equivalent to a probability of a latent cancer fatality of about 6.3×10^{-7}.

For rail shipments of mill tailings from the Moab site to Crescent Junction, the maximally exposed member of the public would be a resident who lived along the rail line on which the tailings were shipped. This person would receive a radiation dose of 0.53 mrem/yr, which is equivalent to a probability of a latent cancer fatality of about 3.2×10^{-7}.

Accidents. If trucks were used to transport the mill tailings from the Moab site to Crescent Junction, the maximally exposed individual would receive a radiation dose of 0.16 mrem, or 1.6×10^{-4} rem from the maximum dose reasonably foreseeable for a transportation accident involving a shipment of mill tailings. This is equivalent to a probability of a latent cancer fatality of about 9.6×10^{-8}. The probability of this accident is about 0.1 per year.

If this accident occurred near Moab, the population would receive a collective radiation dose of 1.8×10^{-3} person-rem, which is equivalent to a probability of a latent cancer fatality of about 1.1×10^{-6}. If this accident occurred in a rural area, the population would receive a collective radiation dose of 2.9×10^{-6} person-rem, which is equivalent to a probability of a latent cancer fatality of about 1.7×10^{-9}.

If rail were used to transport the mill tailings from the Moab site to Crescent Junction, the maximally exposed individual would receive a radiation dose of 1.4 mrem or 1.4×10^{-3} rem from the maximum dose reasonably foreseeable for a transportation accident involving a shipment of mill tailings. This is equivalent to a probability of a latent cancer fatality of about 8.5×10^{-7}. The probability of this accident is about 0.5 per year.

If this accident occurred near Moab, the population would receive a collective radiation dose of 0.017 person-rem, which is equivalent to a probability of a latent cancer fatality of about 1.0×10^{-5}. If this accident occurred in a rural area, the population would receive a collective radiation dose of 2.7×10^{-5} person-rem, which is equivalent to a probability of a latent cancer fatality of about 1.6×10^{-8}.

4.3.15.3 Monitoring and Maintenance Impacts

Monitoring and maintenance activities would include checking water quality and installing a long-term ground water remediation system at the Moab site, and conducting periodic maintenance and inspections of the Crescent Junction site (checking for erosion, damaged fencing, etc.). None of these activities would be expected to breach the cap over the tailings; installation of the ground water system would be done in clean areas after remediation was complete. Data from another UMTRCA site indicate that the Crescent Junction alternative would be effective in isolating the contaminants in the tailings from individuals conducting activities on the site. DOE (2001) concluded that both radon and gamma levels associated with the capped-in-place tailings pile at the Shiprock site in New Mexico were indistinguishable from naturally occurring radiation levels. Therefore, the latent cancer fatality risk to workers conducting monitoring and maintenance would be comparable to the risk from background levels of radioactivity in Utah, about 3×10^{-4} per year of exposure.

4.3.15.4 Impacts from All Sources

Under the Crescent Junction off-site disposal alternative, less than one fatality would be estimated to occur from construction activities under any of the transportation options. Transportation of contaminated materials from the Moab site to the Crescent Junction site would result in the exposure of workers and the public to very small amounts of radiation; these exposures would not be expected to result in any latent cancer fatalities to any population. Ammonia releases from ground water remediation would be well below threshold concentrations for human health effects.

Based on as-built radon flux measurements from completed uranium mill tailings disposal cells constructed under both Title I (federal UMTRA sites) and Title II (private licensees) of UMTRCA, it is anticipated that actual radon flux would be two orders of magnitude less than the 20-pCi/m^2-s EPA protective standard promulgated in 40 CFR 192. However, even though DOE's experience supports a conclusion that radon release rates from the capped pile would be negligible and that DOE's long-term monitoring and maintenance of the site would ensure cap integrity, for the purpose of supporting analyses of long-term performance and impacts, DOE has also assessed impacts assuming the maximum allowable release rate of radon, 20 pCi/m^2-s, under EPA's regulations (40 CFR 192).

Based on this emission rate and the dimensions of the disposal cell, the latent cancer fatality risk for a nearby resident would be 6.2×10^{-7} per year of exposure, or 1.8×10^{-5} over the 30-year

period following the end of construction and operations. This latent cancer fatality risk is less than the risk from background levels of radioactivity in Utah, about 3×10^{-4} per year of exposure.

For the population near the Crescent Junction site, the latent cancer fatality risk would be 2.0×10^{-3} over the 30-year period following the end of construction and operations.

At the Moab site, radon emissions would fall to background levels because the mill tailings pile would have been relocated. The latent cancer fatality risk would be comparable to the risk from background levels of radioactivity in Utah, about 3×10^{-4} per year of exposure.

The design life of the disposal cell for the uranium mill tailings is 200 to 1,000 years. Over this period of time, the amount of radioactivity in the disposal cell will decrease slightly, less than 1 percent, due to the half lives of the radionuclides in the uranium mill tailings.

In the time frame of 200 to 1,000 years, the major route of exposure of people would be through the inhalation of radon progeny from the disposal cell. There is no surface water pathway at the Crescent Junction site. The uppermost aquifer at the Crescent Junction site is 3,000 ft below the surface, and the travel time to the uppermost aquifer is over 170,000 years, so it is unlikely that ground water would contribute large latent cancer fatality risks relative to inhalation of radon progeny. With the disposal cell cover in place and the Crescent Junction site being under perpetual care, it is likely that the latent cancer fatality risk for an inadvertent intruder would also be low.

After the disposal cell cover was installed, the estimated annual latent cancer fatality risk from radon for a nearby Crescent Junction resident would be 6.2×10^{-7}. As with the radioactivity in the disposal cell, the annual risk would also not decrease appreciably over the 200- to 1,000-year time frame. Therefore, the annual latent cancer fatality risk for a nearby Crescent Junction resident would be about the same immediately after the cover was installed as it would be 1,000 years after the cover was installed. This assumes that the nearby resident remains at his or her present location. If the resident were to move closer to the disposal cell, the annual latent cancer fatality risk would be similar to the risk at the Moab site, 8.9×10^{-5} per year of exposure.

Based on the 20-pCi/m^2-s radon release rate, for the population within a 50-mile radius of the Crescent Junction site, the annual latent cancer fatality risk was estimated to be 6.7×10^{-5}. As with the radioactivity in the disposal cell, the annual risk would also not decrease appreciably over the 200- to 1,000-year time frame. If it is assumed that the population around the Crescent Junction site remains constant over 1,000 years, then the estimated latent cancer fatality risk over the 1,000-year time period would be 0.07.

4.3.16 Traffic

Traffic impacts under the Crescent Junction off-site disposal alternative would be qualitatively identical and quantitatively very similar to those described for the Klondike Flats off-site disposal alternative in Section 4.2.16. Under the truck transportation mode, the percent increase in traffic on US-191 from transporting the tailings would affect approximately 12 more miles of the highway due to the additional distance from the Moab site. A second difference is that road transportation of cover soils borrow material (43 daily round trips; see Table 2–7) required for the Klondike Flats disposal alternative would not be necessary because these soils would be

available at the Crescent Junction disposal site. The resulting difference in percent increase in traffic is shown in Table 2–32. Because all other aspects of traffic impacts would be the same, the full analysis of traffic impacts is not repeated in this section.

4.3.17 Disposal Cell Failure from Natural Phenomena

It is possible that a disposal cell failure could occur at the Crescent Junction site. The possibility of failure at this site is much lower than at the Moab site because it was selected for analysis, in part, to avoid the more dynamic characteristics of the Moab site (see Chapter 3.0). The Crescent Junction site is not located near a river, does not have historical seismic activity, and is not prone to settling. In addition, this site is located farther away from populated areas or sensitive habitats than the Moab site, which would reduce the potential risks if a disposal cell failure occurred. Therefore, the possibility of a failure occurring and resulting in potential risks at the Crescent Junction site would be much lower than the potential risks of a disposal cell failure at the Moab site. For this reason, a potential failure at this site was not evaluated.

4.3.18 Environmental Justice

The basis for DOE's analysis of environmental justice impacts is described in Section 4.1.18. One census block area with a reported annual household income less than $18,244 (poverty level for a family of four) is found about 25 miles north of the Crescent Junction site. Although this population could be exposed to small doses of radiation as a result of activities under this alternative, there is no evidence that it would be exposed at a level any higher than the general population. Although traffic in central Moab would be an adverse impact, it does not appear that minority or low-income populations would suffer disproportionately.

DOE has identified no high and adverse impacts, and no minority or low-income populations would be disproportionately affected by the implementation of the Crescent Junction off-site disposal alternative.

4.4 Off-Site Disposal (White Mesa Mill Site)

This section discusses the short-term and long-term impacts associated with off-site disposal at the White Mesa Mill site, the third of the three off-site disposal alternatives. The White Mesa Mill site is located approximately 85 miles south of the Moab site. The impacts are based on the proposed actions described in Section 2.2 and the affected environment described in Sections 3.1 and 3.4. This alternative may result in the following impacts:

- Impacts at the Moab site
- Impacts at the White Mesa Mill site
- Impacts associated with moving tailings from the Moab site to the White Mesa Mill site

The combined impacts that could result from these activities are summarized for each assessment area (e.g., Geology and Soils) at the end of each subsection. For many activities, impacts at the Moab site would not differ significantly from those described in Section 4.2 for the Klondike Flats site. Likewise, construction and operation impacts at the White Mesa Mill site would be